THE VALUE OF VACCINATION

AS SHOWN BY AN ANALYSIS OF

10,403 CASES OF SMALLPOX,

BY

W. GAYTON, M.D., F.R.S.E.

MEMBER OF THE ROYAL COLLEGE OF PHYSICIANS OF EDINBURGH, &c;

MEDICAL SUPERINTENDENT OF THE NORTH-WESTERN HOSPITAL;

FORMERLY MEDICAL SUPERINTENDENT OF THE HOMERTON SMALLPOX HOSPITAL.

HOSPITAL SHIPS "ATLAS" AND "ENDYMION," AND DARENTH SMALLPOX CAMP (1881).

3rd EDITION.

PRICE ONE SHILLING.

LONDON:

PRINTED BY GILLETT & HENTY,

HOLLOWAY ROAD, N.

1901.

22502807148

THE VALUE OF VACCINATION

AS SHOWN BY AN ANALYSIS OF

10,403 CASES OF SMALLPOX,

BY

W. GAYTON, M.D., F.R.S.E.

MEMBER OF THE ROYAL COLLEGE OF PHYSICIANS OF EDINBURGH, &c;
MEDICAL SUPERINTENDENT OF THE NORTH-WESTERN HOSPITAL;
FORMERLY MEDICAL SUPERINTENDENT OF THE HOMERTON SMALLPOX HOSPITAL.
HOSPITAL SHIPS "ATLAS" AND "ENDYMION," AND DARENTH SMALLPOX CAMP (1881).

LONDON:
PRINTED BY GILLETT & HENTY,
HOLLOWAY ROAD, N.

WELLCOME
LIBRARY
General Collections
P
1745

THE

VALUE OF VACCINATION

AS SHOWN BY AN ANALYSIS OF

10,403 CASES OF SMALLPOX.

From time to time, in my official Reports to the Managers of the Metropolitan Asylums Board, I have brought under their notice analyses of the cases of Smallpox which have come under my care during various periods. In the following pages I purpose giving the statistics of 10,403, endeavouring to show the influence exercised by good vaccination and imperfect vaccination, at different ages.

My remarks will be confined to observations actually made by myself; and, I believe, with the exception of those prepared by the late Mr. Marson, of the Highgate Smallpox Hospital, the present is the largest collection that can be referred to.

No one who has come much into contact with those suffering from Smallpox (a disease justly described as the most loathsome disorder to which the human subject is liable) can hesitate, one would think, to state in the most emphatic manner that vaccination exerts a wonderful and powerful influence on the form, the progress and the result of the disease ; and this, indeed, becomes self-evident, when contrasted with the unvaccinated and those doubtfully protected ; but the grand result which Jenner anticipated—viz., the total and complete extinction of the scourge from our species—has not yet been arrived at, and in large cities probably never will be ; and, indeed, until the public mind is satisfied of the authenticity and honesty of results as they are compiled, the universal vaccination of children, of the educated and uneducated alike, will not be effected ; personal eccentricities, prejudice, and strong convictions, whether well-founded or not, are together almost insurmountable difficulties to combat. Even the medical profession itself cannot be said to be unanimous in their assent to the practice, although the number of dissentients is certainly infinitesimal.

The subject has been so elaborated in many essays that to some it may appear quite possible that nothing remains to be said. I venture, however, to hope that I may at least be credited with good intentions in bringing my share of information under notice, and in endeavouring to show that epidemics of this appalling disease which have appeared within our memory, have been mercifully stripped of the horrors of those before our time by the immortal benefactor to whom mankind owes so much. It must be remembered that only during 15 or 16 years have any extended

observations been made and records carefully kept of the value and efficiency of vaccination, culminating in an almost universal acceptance of its power.

As in times gone by, so now. Smallpox attacks a large number of persons who have, beyond question, been vaccinated; and although it might perhaps be maintained, and apparently with good reason, that vaccination is often performed without due care, either in the manner of the operation, or the selection of the lymph, yet the fact remains, and we should not hide it, whether it leads to misgivings as to the protective power of vaccination or otherwise. Against any disadvantages, however, can be set an overwhelming good, which is that very many vaccinated persons either escape Smallpox altogether, or, if they do contract it, suffer comparatively little. This modifying influence, however, in changing a most fatal disease to a slight and comparatively unimportant one, is nevertheless only to be obtained when the operation has been well performed, and nothing short of this suffices; true it is, that even in some well-vaccinated subjects this modification is not observed, but these stand out as the very rare exceptions to a general rule.

Admitting, therefore, without hesitation, that it does not altogether protect, it nevertheless does mitigate to a large extent, this fact becoming more and more clear when cases are massed in large numbers. THEN it is shown conclusively that THE SEVERITY OF THE DISEASE DECREASES IN PROPORTION TO THE EFFICIENCY OF THE VACCINATION; thus, as regards 282 MALES with one good mark, 12 died, or 4·2 per cent.; of 375 with two good marks, 15 died, or 4 per cent.; of 302 with three good marks, 7 died, or 2·3 per cent.; and

of 204 with four or more good marks, 4 only died, or 1·9 per cent. Amongst FEMALES, of 247 with one good mark, 10 died, or 4·04 per cent.; of 274 with two good marks, 7 died, or 2·5 per cent.; of 216 with three good marks, 5 died, or 2·3 per cent.; and of 185 with four or more good marks, 2 died, or 1·08 per cent.; or taking 1,163 MALES with one, two, three, four, or more good marks, 38 died, or 3·26 per cent.; of 922 FEMALES with a similar number and quality of vaccination, 24 died, or 1·08 per cent. The combination of males and females with GOOD marks, irrespective of number, giving a death rate of 2·6 per cent.

As regards those with IMPERFECT marks (and to this class the large mass of the patients admitted into Smallpox Hospitals belong) we find that 821 MALES were seen with one mark, of whom 122 died, or 14·7 per cent.; 908 with two marks, of whom 96 died, or 10.5 per cent.; 546 with three marks, of whom 39 died, or 7·1 per cent.; and 395 with four or more marks, of whom 13 died, or 3·2 per cent. Of FEMALES, 638 were received with one mark, and 76 died, or 11·9 per cent.; 668 with two marks, of whom 60 died, or at the rate of 8·9 per cent.; 509 with three marks, of whom 31 died, or 6·09 per cent.; and 369 with four or more marks, of whom 18 died, or 4·8 per cent.; thus giving a gross mortality in 2,670 males with one, two, three, four, or more IMPERFECT marks, of 10·11 per cent.; and in 2,184 females with a like condition of protection, of 8·46 per cent. The total mortality amongst males and females with IMPERFECT marks, irrespective of number, being 9·37 per cent., as compared with 2·6 per cent., amongst those with GOOD marks.

The great contrast thus seen between the well vaccinated* and those only partially or imperfectly protected is unmistakable and incontrovertible, the difference being that in the former the disease is, as a rule, of the mildest form, in many cases scarcely worthy of the name of an illness, whilst in the latter it is not unfrequently most severe, terminating but too often in death. There is, therefore, vaccination AND vaccination, vaccination carefully, efficiently, and well done, protective in the highest degree, and vaccination carelessly and badly done, giving a false confidence to its owner, and affording little defence either from life-long disfigurement or a fatal termination. It has but too truly been said that "the operation, as an operation, has not been properly estimated from its first introduction into England; and it should be looked upon as a blot on our policy that vaccination has been worse performed generally in England, its birthplace, than in any other country in Europe." This imperfect vaccination, however, insures an intermediate security, varying in a wide range according to the number of the cicatrices, the extent of area, the amount of foveation, and so forth, and forms a broad line of demarcation when compared with those possessing good marks, and again with the doubtfully vaccinated, and confessedly unvaccinated.

---

*A term little understood outside the medical profession, but which carries with it the highest practical value, indicating neatness, care and skill, and defining almost with mathematical precision, the course an attack of uncomplicated Smallpox will take; in a word, a well-vaccinated person is one who has at least four marks or cicatrices, each one being "foveated, dotted, or indented, in some cases radiated and having a well, or tolerably well defined edge," and further, occupying a superficial area of not less than one third of a square inch.

It has not unfrequently been stated that we commit an injustice to those who have been vaccinated, and yet present no ocular evidence by means of the Smallpox eruption or from any other cause, to class them with the unvaccinated. This, however, like many other general objections, is well or ill founded according to the sense in which the terms are employed. If in the objector's mind the class "unvaccinated" conjures up the idea that, with a dishonest motive, the term is used for the purpose of swelling the good results of vaccination, and lowering the opposite, the objection is undoubtedly well founded; but, if on the contrary, all that we venture to do is to deduce from good or bad vaccination an elucidation of the great and important question as to its relative value in reference to the protection it gives from Smallpox, then I apprehend that the objection is ill founded. My main object, and I believe it to be the same with others, is to produce a plain statement of facts as they have been derived from practice alone; nevertheless, not doubting but that our results will, as heretofore, be called in question, our motives impugned, aud our veracity challenged. The same holds good in most mundane affairs, and why not in this? But it is obvious that as sanitary science becomes more and more widespread; as figures based upon reliable data accumulate; and as the results noted by different observers more and more closely approximate, these facts will be accepted as such. We know full well that many of the lower class are afflicted with a certain old-fashioned notion that sanitation is worthless, and so also is vaccination; or, at all events, that it may be either taken advantage of or neglected as anyone pleases. With them,

also, it is an article of faith that as their fathers never died from bad air, so of necessity it should not follow that they should fall victims to it. No doubt, thanks to the noble educating influence of medical practitioners, and the rapid general advance of science amongst all classes, the foolish prejudice against vaccination is fast dying out. It is, however, a worse that thankless task to endeavour to argue with a firm disbeliever in its protective power. To meet, however, the anticipated objection, a separate, class it will be observed, has been made—viz., of those "said to be vaccinated but without evidence"—and what are the results derived from a consideration of it? Briefly these—that 692 males have come under treatment, of whome 204 died, or a mortality of 29·4 per cent.; and 603 females, with 148 deaths, or a death rate of 24·5 per cent. We have, I maintain, no right to accept a mere assertion of vaccination as conclusive. The performance of the operation, irrespective of results, is one thing; the typical character of the cicatrix is, however, the only trustworthy proof. And here, again, is at once seen a wide and marked difference between the two classes, a difference not to be gainsayed or argued away by the firmest disbeliever in the protective power of the vaccine lymph; with this proviso, however, that he approaches the subject with all honesty of purpose, and is prepared to be convinced even against his will, and in spite of any opinion he may have originally formed. Figures are stubborn facts, and in the case under consideration, are beyond dispute or mistake.

Smallpox at the present time is as terribly mutilating, and as

fatal a disease amongst the unvaccinated as it was formerly, and looking back upon the reminiscences of some years' experience in this malady, one involuntarily shudders at the idea which may be some day realised—viz., a repeal of the Compulsory Vaccination Act. If it were possible, and the agitation-mongers were willing, I would ask them to afford us a crucial test of their faith by residing for a few weeks in an Institution devoted to the treatment of this special disease. In this way they would be able to compare for themselves the effects of the attack in the well-protected, the indifferently protected, the doubtfully protected, and the confessedly unprotected: then (and I write in all earnestness) they would, I am convinced, turn their backs upon a theory which, when carried out, wrecks many a domestic circle—renders what was once beautiful and pleasant to look upon, hideous in the extreme—or sets in motion a long train of symptoms frequently resulting in premature death. Surely—granted vaccination does not absolutely protect from attack, if it can be shown that instead of a human creature, stricken by this disease, becoming a mass of corruption, obnoxious equally to sight, smell, and touch, and from whom even those accustomed to such sights involuntarily recoil, it is possible to modify all such horrors by an operation like vaccination, simple in character, and, as a rule, harmless in effect upon the present and future health—one would think that the offer would be eagerly accepted, and such a safeguard from death or disfigurement be hailed as a Divine blessing. Examining the table, what is found as the result of an attack of Smallpox in the unvaccinated? Taking all ages in males, the death rate will

be 45·2 per cent.; in females, 40·8 per cent.; but in children of both sexes, from birth until five years of age, the mortality becomes 56·5 per cent.; this being the case, as some one aptly puts it, "better let the parent or guardian who declines to have his child vaccinated at once compound for an indulgence to commit infanticide, not perhaps in the case of his own offspring, but in that of others, by aiding to prevent the extinction of the disease."

The age at which a re-development of susceptibility to Smallpox occurs after vaccination would, according to my experience, appear to be greatest between 15 and 20 years; but prudence would dictate the testing, several years before the age of 15, the efficacy of the vaccination done in infancy, as there is, it would appear, even a liability to contract, in some few instances, Smallpox at a very early period after vaccination. Thus Willan records cases in which Smallpox occurred in vaccinated children as early as five months, but "the disease was modified and unimportant in character," but "nevertheless was true Smallpox." A reference to my table also shows the admission of 11 infants under one year of age; but of these TWO ONLY were well vaccinated. Against these we may set the fact that 173 vaccinated children came under observation, who at the time of admission were being suckled; in but very few instances were they removed from the breast, not a single one, however, was affected by Smallpox. That these remained unscathed affords, to ordinary minds, another, amongst the many striking proofs of the protective power of vaccination.

Every one who has seen much of Smallpox is, I take it, prepared to admit that Jenner's opinion that "a single pustule is

sufficient to secure the constitution from the Smallpox,"is incorrect; as also the hypothesis that " the system of a person who had been vaccinated was in exactly the condition of a person who had had Smallpox in the natural way." " Duly and efficiently performed," he wrote, " it will protect the constitution from subsequent attacks of Smallpox as much as that disease will; I never expected it would do more, and it will not, I believe, do less." Proofs are abundant already, and will continue to accumulate, to disprove these statements ; but I know not in what way we could arrive at the proportion of vaccinated persons who afterwards take Smallpox. It would be useless to re-open the controversy respecting the AD CAPTANDUM argument that a large number of vaccinated persons become the subjects of Smallpox, because such a discussion is invariably met by a positive and fierce affirmation, and a triumphant reference to the Reports of different Hospitals in corroboration of the statement. It must be conceded that in a certain but limited sense this reading of the statistics is consistent, as a glance at the figures will show that 8,234 vaccinated, or said to be so, came under treatment, as against 2,169 unvaccinated. But is it justifiable to admit that these were placed in such a position as Jenner contemplated, or as would give a reasonable expectation that they ran no ordinary risk of contracting Smallpox ? If we maintain (and the fact is now almost universally admitted in the medical world) that vaccination "DULY AND EFFICIENTLY PERFORMED" protects the constitution from attacks of the disease up to or about puberty, how do the figures I have collected help in our defence ? Shortly, they show that 2,085 presented GOOD marks, but that only 907 were

protected in such a way as to warrant their being classified as "well vaccinated."

The subject, it must be admitted, deserves all the attention and painstaking enquiry that can be instituted, and, however disappointing it may be, both to the laity and profession alike, it should nevertheless be openly admitted; indeed, I would go further and say, it should be pressed home to the public, that post-vaccinal Smallpox is of common occurrence, and brings by far the larger proportion of inmates to the Smallpox Hospitals. Whether the failure to ensure the anticipated universal protection from attack is owing to the employment of lymph lacking its original efficiency, and hence not causing the changes in the system which should have been excited at the time of the operation, is a question naturally and justly raised by the facts I have alluded to.

As, then, we are of necessity bound to acknowledge, however reluctant some may be to do so, that a certain percentage of persons, even if fairly well vaccinated, contract Smallpox, we have to show the amount of security obtained by repeating the operation; and—when we bear in mind that the number and character of vaccine marks on the person are of the highest importance, as regards both the degree of protection afforded against Smallpox and the degree in which it controls the fatality of the disease when it occurs; also the very large amount of bad vaccination that is seen, the great intercommunication that must of necessity exist in all large cities, and the endemic form that Smallpox has now apparently assumed—it appears to be a good general rule to recommend that all about puberty [which in this country generally

commences between the ages of 13 and 15 in females, and a year later in males] should be revaccinated, that appearing to be the period at which a large proportion of previously vaccinated persons become again susceptible to Smallpox infection. Some have pointed out that the liability to contract the disease appears to diminish before and after a certain age. It must, however, be admitted that there does not appear to exist any physiological reason for such being the case, but rather that the larger proportion of the population about middle life have either at some previous time suffered from the disease, or have been revaccinated; and that the immunity of young children is certainly not complete, and far from being so great as is sometimes supposed; one cause, perhaps, of an apparent freedom being the less exposure to contagion. The propriety of revaccination, even at all ages after five, cannot admit of much doubt, more especially as the process cannot be considered as a disease, so trivial are the symptoms attendant on it, and so protective, apparently, is the result. The rapid increase in the ratio between the ages of 15 and 20 indicates clearly that at this time particularly vaccinated persons become liable to attack; and it is, therefore, imperatively necessary to repeat the operation. There appears to have been also reason to think that revaccination need not be repeated more than once, but it should be well done. Nobody should consider he has been revaccinated satisfactorily who has been operated on with lymph long stored, or without results, as seems to be the case in a large number of people who say they have been revaccinated and "did not take." When-

ever there is any special prevalence of the disease, and any doubt as to the efficiency of the revaccination, there is nothing but wisdom in the repetition of the operation. As long as a person was successfully revaccinated the last time, so long is it uncertain that he will not take again; and so long as he is liable to be affected by vaccination, so long, I imagine, is he liable to take Smallpox. Thus, then, we may advise those who did not take the last time that they are efficiently vaccinated, and recommend those who did take to be done again. Whether any one vaccination is completely protective for a time in those who subsequently take again, and if so, what that time may be, we do not know. The revaccination of persons who have had Smallpox has also been advised; and several cases have come under observation in which very fair vesicles have been produced, not only in those who have had Smallpox, but at the very time they were suffering from an attack of the disease. Our experience, however, shows that a previous attack of Smallpox, has generally given a future protection, in the same way that an attack of Measles, Scarlet Fever, Chicken-pox, &c., is not repeated, except but very rarely. It seems a truism to repeat that Smallpox is unknown amongst the nurses and others in the Hospital The fact has so often and so prominently been brought forward, not only by me, but by others connected with kindred institutions, that we have almost taught ourselves to believe that no one would deny it. I have not at hand the record showing the number of persons employed under my observation, but in June, 1878, the following appeared in the Registrar General's Return: "In a recently published Report, dealing with the statistics of the Homerton

Smallpox Hospital for 1st February, 1871, when patients were first received, till 31st December last, Dr. William Gayton, the Medical Superintendent, makes a statement bearing upon the efficacy of adult revaccination as a protection from Smallpox which cannot be too generally known." He says: "That ONE only amongst the large number of nurses and others who have been occupied here (and in her case THE OPERATION WAS NEGLECTED) should have contracted the disease is, or should be, convincing proof of its great and almost certain prophylactic influence. . . . . Dr. Gayton has further informed the Registrar General that, since the Hospital was opened, more than seven years ago, 367 nurses and others have been engaged in the work of the Hospital, and, with the solitary accidental exception mentioned, revaccination has been an indispensable condition of employment, unless the applicant has had Smallpox or had already been revaccinated. The result has been that not one of these have contracted Smallpox while there employed." What was written then, is true now; and the absence of attack in those brought most immediately in contact with those suffering is NOT due, as has been alleged, to any care on the part of the officials to secure persons who have either been patients in the Hospital upon some former occasion, or have suffered elsewhere from a previous attack; on the contrary, very few have been engaged in the establishments with which I have been connected, who, before commencing duty, had ever been within the building; and the large amount of revaccinations performed is a further denial to the statement that they were selected by reason of their protection by a previous attack of Smallpox.

I am unable to give statistics to any extent relative to Smallpox subsequent to revaccination. What is found is simply that, during 14 years' experience, 46 patients have been admitted who stated they had undergone the operation more than once, of whom four died. In these cases I was able to discover ocular proof in 28 instances; as all the persons who thus presented themselves were adults, it is but fair to credit their statement. Nor do I think we should in any way whatever advance a very desirable practice if, because a case now and then occurs said to be, and beyond doubt revaccinated, we immediately begin to cast about in order to find some plausible reason or excuse for its prophylactic influence not having fulfilled all that was anticipated. Advocates of vaccination, I believe, are agreed that "even with the best lymph, and with every care, failures to some extent are met with and that it is only in the minority of cases that the same degree of success as attends a primary vaccination is attained;" the regular phenomenon of vaccination apparently being produced but once and once only in a lifetime. If this be true then, and it is true to demonstration, it is manifestly unfair to doubt the veracity of the statement made by the patient or his friends; but measuring the protection revaccination does afford, as far as our experience goes, it is as nearly absolute as can be; and this opinion becomes strengthened year by year nay, month by month, by the fresh engagement of servants and others, who, though not all in immediate contact with the sick, yet necessarily at times come into close proximity with them, and certainly are continually living in a more or less infected atmosphere. Whether this power of

resistance will be lost again by time there is I take it, not sufficient evidence to form a correct opinion. It is, perhaps, possible that, were all those who have been engaged in Smallpox Hospitals, and therefore presumably were revaccinated, traced, in years to come some might perhaps be found who, in spite of it, had contracted the disease. The history and effects of revaccination, therefore as reported by the late Mr. Marson after 30 years' observations, repeat themselves here, but for a shorter period, and as epidemics rose and fell during his time the same as in ours, and the necessity or not for the employment of a larger or smaller staff became imperative, so I anticipate it would be found that those revaccinated by him did not remain a longer time under his eye than similar cases have under mine, and may, therefore, ere now have had the disease in some form or the other. The operation but once repeated, and the period of security thus ensured, will be determined in years to come; its utility and necessity must not stand on any speculative theories, but upon broad grounds of observation and experience; and if it is found that it becomes necessary to repeat the operation, say every five or seven years, the sooner the need for this is appreciated the better, so that persons should not be lulled by a false notion of impregnable security against attack. In estimating the value of a revaccination, it should be borne in mind that the cicatrices are frequently small and poor, and sometimes wanting altogether, and this absence confirms a notion I have been led to form by other considerations, that they are not nearly as persistent as the vaccination marks of infancy. Dr. Wm. B. Carpenter some years

ago, gave me the following information in support of this theory: He says, " at about 25 years of age, I revaccinated myself accidently with vaccine taken almost direct from the cow, having chanced to scratch the ball of my thumb with a charged lancet. I had a remarkably fine " Jennerian" vesicle, leaving a deep pit behind it, but of this there IS NOT THE VESTIGE OF ANY MARK, and, as far as I remember, there never was after it had once healed." I believe this to be the case with other cicatrices, which are far more persistent when established in infancy than when at, or near to, adult age.

Lastly, the number of cases of recurrent Smallpox has been 92. We cannot, therefore, come to a different conclusion than that " Smallpox but seldom occurs a second time," and that, like Measles and Scarlatina, the instances are very rare indeed. Marson stated that "there was no record of a patient having been admitted into the Hospital twice, each time suffering from Smallpox;" and this was after the establishment had existed for 119 years. Seaton however, expresses astonishment "that any physician should ever have been found to express a doubt of the possibility of the recurrence of Smallpox." Aitkin, after stating that Smallpox like Measles has the property of exhaustion,goes on to say, "this law, however, is not without exceptions;"and refers to an epidemic at Marseilles, during which it was considered by Bosquet that one person in a hundred was attacked a second time. Literature on this subject differs very widely; some authorities evidently doubting the possibility of a recurrence of the disease, and others again referring to cases where attack has followed upon attack,

culminating, one may say, in the story by Dr. Baron of the unfortunate surgeon of the South Gloucestershire Militia, who apparently was so susceptible that "he took Smallpox every time he attended a patient labouring under that disease;" no record is extant setting forth the termination of this unhappy man's existence, whether by Smallpox or otherwise.

On adding together the results I have brought into some order, it will be seen that they are eminently favourable to vaccination, varying according to the class in which they should be honestly, and have been to the best of my ability, tabulated—in other words, what I have written is what I myself have seen; all the errors of observation, if any, are mine and mine only, though my judgment was often confirmed by my colleagues. But, leaving the largest margin for error which experience of human fallibility might induce us to do, we still have the remarkable fact that out of many thousands attacked, a certain number are protected from death, maintaining an almost mathematical ratio, according to the manner in which the operation of vaccination has been performed. The reader will forgive the frequent introduction of some well-known matters, since, for the purpose of my argument, I wished the cases to be seen with my own eyes, so to speak, as in no other way could the truth of my statements be equally well attested, and the correctness or error of my explanations be made manifest.

Ages.	Vaccinated with good marks. Males.—Number of marks. 1 Good. Admitted.	Died.	Mortality per cent.	2 Good. Admitted.	Died.	Mortality per cent.	3 Good. Admitted.	Died.	Mortality per cent.	4 or more Good. Admitted.	Died.	Mortality per cent.	Combined Mortality in Males
Under 1 year	...	...	...	...	...	...	...	...	...	2	...	...	...
From 1 to 2 years	...	...	...	...	...	...	1	...	...	...	...	...	...
„ 2 „ 3 „	1	...	...	...	...	...	...	...	...	2	...	...	...
„ 3 „ 4 „	...	...	...	...	...	...	6	...	...	3	...	...	...
„ 4 „ 5 „	2	...	...	2	...	...	5	...	...	4	...	...	...
„ 5 „ 10 „	22	...	...	21	...	...	23	...	...	36	...	...	...
„ 10 „ 15 „	32	...	...	63	...	...	59	2	3·3	41	...	...	1·02
„ 15 „ 20 „	74	1	1·3	113	2	1·7	117	1	0·8	49	...	...	1·13
„ 20 „ 25 „	76	2	2·6	82	1	1·2	55	1	1·8	36	3	8·3	2·81
„ 25 „ 30 „	36	4	11·1	45	3	6·6	21	1	4·7	13	1	7·6	7·82
„ 30 „ 35 „	14	2	14·2	26	4	15·3	7	1	14·4	9	...	...	12·5
„ 35 „ 40 „	15	1	6·6	11	3	27·2	4	...	...	7	...	...	10·81
„ 40 „ 45 „	4	1	25·0	5	...	...	3	1	33·3	1	...	...	15·38
„ 45 „ 50 „	1	...	...	1	1	100·0	1	...	...	...	...	...	33·3
„ 50 „ 55 „	2	1	50·0	3	1	33·3	...	...	...	1	...	...	33·3
„ 55 „ 60 „	1	...	...	1	...	...	...	...	...	...	...	...	...
„ 60 „ 65 „	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 65 „ 70 „	2	...	...	1	...	...	...	...	...	...	...	...	...
„ 70 „ 75 „	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 75 „ 80 „	...	...	...	1	...	...	...	...	...	...	...	...	...
„ 80 „ 85 „	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 85 „ 90 „	...	...	...	...	...	...	...	...	...	...	...	...	...
	282	12	4·2	375	15	4·0	302	7	2·3	204	4	1·9	3·26

Ages.	Vaccinated with good marks. Females.—Number of marks. 1 Good. Admitted.	Died.	Mortality per cent.	2 Good. Admitted.	Died.	Mortality per cent.	3 Good. Admitted.	Died.	Mortality per cent.	4 or more Good. Admitted.	Died.	Mortality per cent.	Combined Mortality in Females	Combined Mortality in M. and F.
Under 1 year	...	...	...	...	...	...	...	...	...	...	...	...	...	...
From 1 to 2 years	...	...	...	...	...	...	1	...	...	1	...	...	...	...
„ 2 „ 3 „	...	...	...	...	...	...	...	...	...	1	...	...	7	...
„ 3 „ 4 „	1	...	...	3	...	...	2	...	...	3	..	...	...	...
„ 4 „ 5 „	1	...	...	4	...	...	2	...	...	8	...	...	...	...
„ 5 „ 10 „	18	1	5·5	23	1	4·3	30	...	...	33	...	...	·96	·97
„ 10 „ 15 „	69	2	2·8	67	1	1·4	65	...	...	43	...	...	1·22	1·13
„ 15 „ 20 „	55	2	3·6	77	1	1·2	65	4	6·1	56	1	1·7	3·17	2·93
„ 20 „ 25 „	47	2	4·2	47	1	2·1	31	1	3·2	15	...	...	2·85	2·82
„ 25 „ 30 „	25	1	4·0	28	1	3·5	11	...	...	10	1	10·0	4·05	6·34
„ 30 „ 35 „	11	1	9·9	14	1	7·1	7	...	...	6	...	...	5·26	9·57
„ 35 „ 40 „	9	...	...	5	1	20·0	...	...	...	2	...	...	6·25	9·45
„ 40 „ 45 „	5	1	20·0	4	...	...	...	...	...	2	...	...	11·09	12·5
„ 45 „ 50 „	1	...	...	1	...	...	...	...	...	...	...	...	...	20
„ 50 „ 55 „	2	...	...	1	...	...	1	...	...	...	...	...	...	20
„ 55 „ 60 „	3	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 60 „ 65 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 65 „ 70 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 70 „ 75 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 75 „ 80 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 80 „ 85 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 85 „ 90 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	247	10	4·04	274	7	2·5	216	5	2·3	185	2	1·08	2·60	2·97

Ages.	Vaccinated with imperfect marks. Males. 1 Imperfect. Admitted.	Died.	Mortality per cent.	2 Imperfect. Admitted.	Died.	Mortality per cent.	3 Imperfect. Admitted.	Died.	Mortality per cent.	4 or more Imperfect. Admitted.	Died.	Mortality per cent.	Combined Mortality in Males.
Under 1 year	2	...	...	...	...	...	1	...	...	1	...	...	...
From 1 to 2 years	2	...	...	3	...	...	3	1	33·3	5	1	20·0	15·38
„ 2 „ 3 „	4	1	25·0	4	1	25	6	...	...	5	1	20·0	15·78
„ 3 „ 4 „	8	3	37·5	6	1	16·6	7	...	...	6	...	...	14·81
„ 4 „ 5 „	8	1	12·5	7	1	14·2	8	1	12·5	4	...	...	11·1
„ 5 „ 10 „	75	6	8·0	81	8	9·8	48	1	2·04	76	1	1·31	5.71
„ 10 „ 15 „	101	6	5·9	134	6	4·4	122	2	1·63	77	1	1·29	3·69
„ 15 „ 20 „	165	15	9 09	198	12	6·06	129	7	5·42	80	...	...	5·94
„ 20 „ 25 „	175	34	19·4	171	25	14·6	100	7	7·0	50	2	4·0	13·70
„ 25 „ 30 „	102	20	19·6	121	15	12·3	48	9	18·75	38	3	7·89	15 21
„ 30 „ 35 „	62	12	19·3	78	10	12·8	35	4	11·42	30	1	3·3	13.17
„ 35 „ 40 „	49	12	24·4	43	5	11·6	20	5	25·0	16	...	...	17·11
„ 40 „ 45 „	34	5	14·7	34	9	26·4	10	2	20·0	...	...	..	20·51
„ 45 „ 50 „	16	2	12·5	16	2	12·5	2	...	...	3	2	66·6	16·21
„ 50 „ 55 „	7	2	28·5	7	...	...	4	...	...	2	...	...	10
„ 55 „ 60 „	7	1	14·2	3	1	33·6	2	...	...	2	1	50·0	21·42
„ 60 „ 65 „	1	...	...	2	...	...	1	...	...	...	...	...	...
„ 65 „ 70 „	1	...	...	...	...	...	...	...	...	...	...	...	...
„ 70 „ 75 „	1	1	100	...	...	...	...	...	...	...	...	...	100
„ 75 „ 80 „	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 80 „ 85 „	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 85 „ 90 „	1	1	100	...	...	...	...	...	...	...	...	...	100
	821	122	14·7	908	96	10·5	546	39	7·1	395	13	3·2	10·11

Ages.	Vaccinated with imperfect marks. Females. 1 Imperfect. Admitted.	Died.	Mortality per cent.	2 Imperfect. Admitted.	Died.	Mortality per cent.	3 Imperfect. Admitted.	Died.	Mortality per cent.	4 or more Imperfect. Admitted.	Died.	Mortality per cent.	Combined Mortality in Females.	Combined Mortality in Males & Females
Under 1 year	1	...	...	2	1	50·0	1	...	...	1	...	..	20·0	11·1
From 1 to 2 years	4	...	...	3	...	...	...	...	...	3	...	...	...	8·3
„ 2 „ 3 „	2	1	50·0	4	...	...	5	...	...	5	...	...	6·5	11·42
„ 3 „ 4 „	8	1	12·5	5	3	60·0	7	...	...	8	...	...	14·28	14 54
„ 4 „ 5 „	8	1	12·5	10	1	10·0	8	...	...	7	1	14·2	9 09	10·0
„ 5 „ 10 „	73	5	6·8	68	3	4·4	56	2	3·5	55	1	1·8	4·32	5·07
„ 10 „ 15 „	122	7	5·7	137	6	4·3	139	3	2·1	107	1	·9	3·37	3·40
„ 15 „ 20 „	113	10	8·8	159	13	8·1	119	7	5·3	74	2	2·7	6·84	6·35
„ 20 „ 25 „	110	16	14·5	106	7	6·6	76	4	5·2	55	5	9·09	9·49	12·00
„ 25 „ 30 „	68	12	17·6	76	12	15·7	49	7	14·2	27	2	7·4	15·0	15·12
„ 30 „ 35 „	47	4	8·5	37	1	2·7	28	6	21·4	11	3	27·2	11 38	12·46
„ 35 „ 40 „	28	7	25·0	28	4	14·2	7	1	14 2	7	3	4·2	22·14	18·68
„ 40 „ 45 „	17	4	23·5	16	4	25·0	7	...	...	4	...	...	18·18	19·75
„ 45 „ 50 „	13	2	15·3	5	1	20·0	6	...	...	3	...	...	11·1	14·06
„ 50 „ 55 „	11	4	36·3	4	2	50·0	...	...	...	...	...	...	40 0	22·85
„ 55 „ 60 „	5	1	20·0	4	1	25·0	1	1	100	1	...	...	27·27	24·0
„ 60 „ 65 „	3	...	...	2	1	50·0	...	...	...	...	...	...	20·0	11·1
„ 65 „ 70 „	1	...	...	1	...	...	...	...	...	1	...	...	...	...
„ 70 „ 75 „	3	1	33·3	1	...	...	...	...	...	...	...	...	25 0	40·0
„ 75 „ 80 „	1	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 80 „ 85 „	...	...	...	...	...	...	...	...	...	...	...	...	...	...
„ 85 „ 90 „	...	...	...	...	...	...	...	...	...	...	...	...	...	100
	638	76	11·9	668	60	8·9	509	31	6·09	369	18	4·8	8·46	9·37

Ages.	Vaccinated but without evidence. Males. Admitted.	Died.	Mortality per cent.	Females. Admitted.	Died.	Mortality per cent.	Combined Mortality in Males & Females.
Under 1 year	4	1	25·0	5	5	100	66·6
From 1 to 2 years	6	1	16·6	7	2	28.5	23 07
„ 2 „ 3 „	14	4	28·5	7	4	57·1	38·09
„ 3 „ 4 „	23	14	56·5	16	4	25·0	46·1
„ 4 „ 5 „	22	8	36·3	14	4	28·5	33·3
„ 5 „ 10 „	109	25	22·9	98	15	15·3	19·3
„ 10 „ 15 „	96	20	20·8	118	22	18·6	19·6
„ 15 „ 20 „	96	16	16·6	109	23	21·1	19·02
„ 20 „ 25 „	95	32	33·6	72	24	33·3	33·5
„ 25 „ 30 „	67	22	32·8	49	13	25·5	30·01
„ 30 „ 35 „	46	14	30·4	22	7	31·8	30·8
„ 35 „ 40 „	43	19	44·1	26	9	34·6	40·5
„ 40 „ 45 „	27	10	37·03	25	5	20·0	28·8
„ 45 „ 50 „	18	6	33·3	15	3	20·0	27·27
„ 50 „ 55 „	9	5	55·5	6	2	33·3	46·6
„ 55 „ 60 „	11	6	54·5	5	3	60·0	56·2
„ 60 „ 65 „	4	1	25·0	5	...	...	11·1
„ 65 „ 70 „	1	...	...	2	2	100	66·6
„ 70 „ 75 „	...	...	...	2	1	50·0	50
„ 75 „ 80 „	...	...	...	...	...	...	...
„ 80 „ 85 „	1	...	...	...	...	...	...
„ 85 „ 90 „	...	...	...	...	...	...	...
	692	204	29·4	608	148	24·5	27·18

Ages.	Not vaccinated. Males. Admitted.	Died.	Mortality per cent.	Females. Admitted.	Died.	Mortality per cent.	Combined Mortality in Males & Females.	Gross Mortality in the unvaccinated class under & above 5 years.
Under 1 year	88	52	59·09	67	46	68·6	63·2	56·57
From 1 to 2 years	54	42	77·7	67	41	61·1	68·5	
„ 2 „ 3 „	65	40	61·5	60	37	61·6	61·6	
„ 3 „ 4 „	85	40	47·05	44	25	56·8	46·7	
„ 4 „ 5 „	72	34	47 2	75	26	34·6	41·3	
„ 5 „ 10 „	285	106	37·1	225	74	32·9	35·2	37·19
„ 10 „ 15 „	153	37	24·1	164	37	22·5	23·3	
„ 15 „ 20 „	119	50	42·01	85	36	42·3	42·3	
„ 20 „ 25 „	108	53	49·07	66	30	45·4	47·7	
„ 25 „ 30 „	61	36	59·01	44	20	45·4	53·3	
„ 30 „ 35 „	33	16	48·48	20	6	30·0	41·5	
„ 35 „ 40 „	30	14	46·6	20	6	30·0	40	
„ 40 „ 45 „	19	10	52·7	7	3	42·8	50	
„ 45 „ 50 „	11	5	45·4	12	3	25·0	34·7	
„ 50 „ 55 „	6	3	50·0	5	4	80·0	63·6	
„ 55 „ 60 „	5	2	40·0	2	1	50·0	48·2	
„ 60 „ 65 „	3	1	33·3	2	...	...	20	
„ 65 „ 70 „	...	...	...	2	...	...	...	
„ 70 „ 75 „	...	...	...	4	2	50·0	50	
„ 75 „ 80 „	...	...	...	1	...	...	...	
„ 80 „ 85 „	...	...	...	...	...	...	...	
„ 85 „ 90 „	...	...	...	...	...	...	...	
	1,197	541	45·2	972	397	40·8	43·70	

OPINIONS OF THE PRESS ON FORMER EDITIONS.

"The chief merits of this pamphlet are first in the eminent reasonableness of the author in his obvious wish to make every allowance to opponents, and secondly in the enormous experience, on the strength of which he speaks."—*Lancet.*

"More convincing proofs of the value and efficiency of vaccination were never published, and we recommend the consideration of the figures to the people who clamour to be allowed to expose their children without this protection to the ravages of Smallpox."—*Standard.*

"I should invite the 'antivacs' to read, mark, and inwardly digest the contents of this *brochure*. . . . Facts, says the poet are 'chiels that winna ding' and I think the 'antivacs' will have rather a bad quarter of an hour in trying to belabour and overthrow, as is their delight and custom, Dr. Gayton's figures and experience."—*Health.*